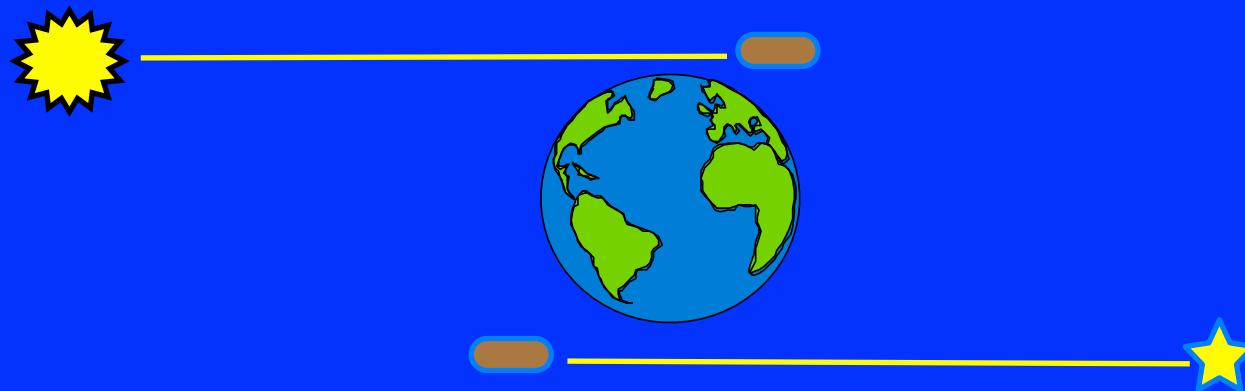


# Ozone time series from GOMOS and SAGE II measurements



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## Motivation:

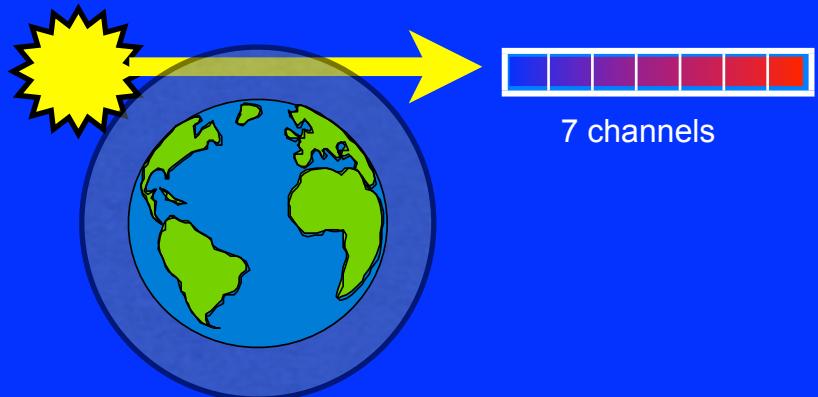
In order to monitor the development of the stratospheric ozone layer long satellite data series are needed.  
Measurements from different instruments must be combined.

## Our case:

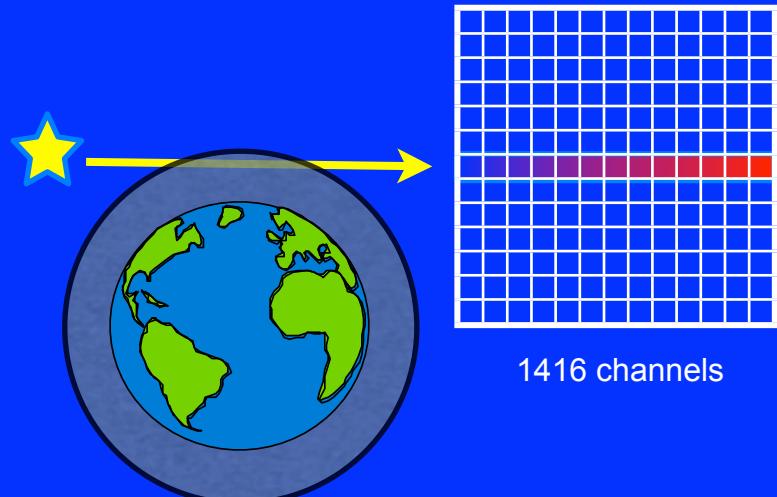
GOMOS data can continue SAGE II measurements

- Self calibrating instruments
- Minimal use of a priori data
- Overlap in 2002-05
- Global latitude coverage

# SAGE II



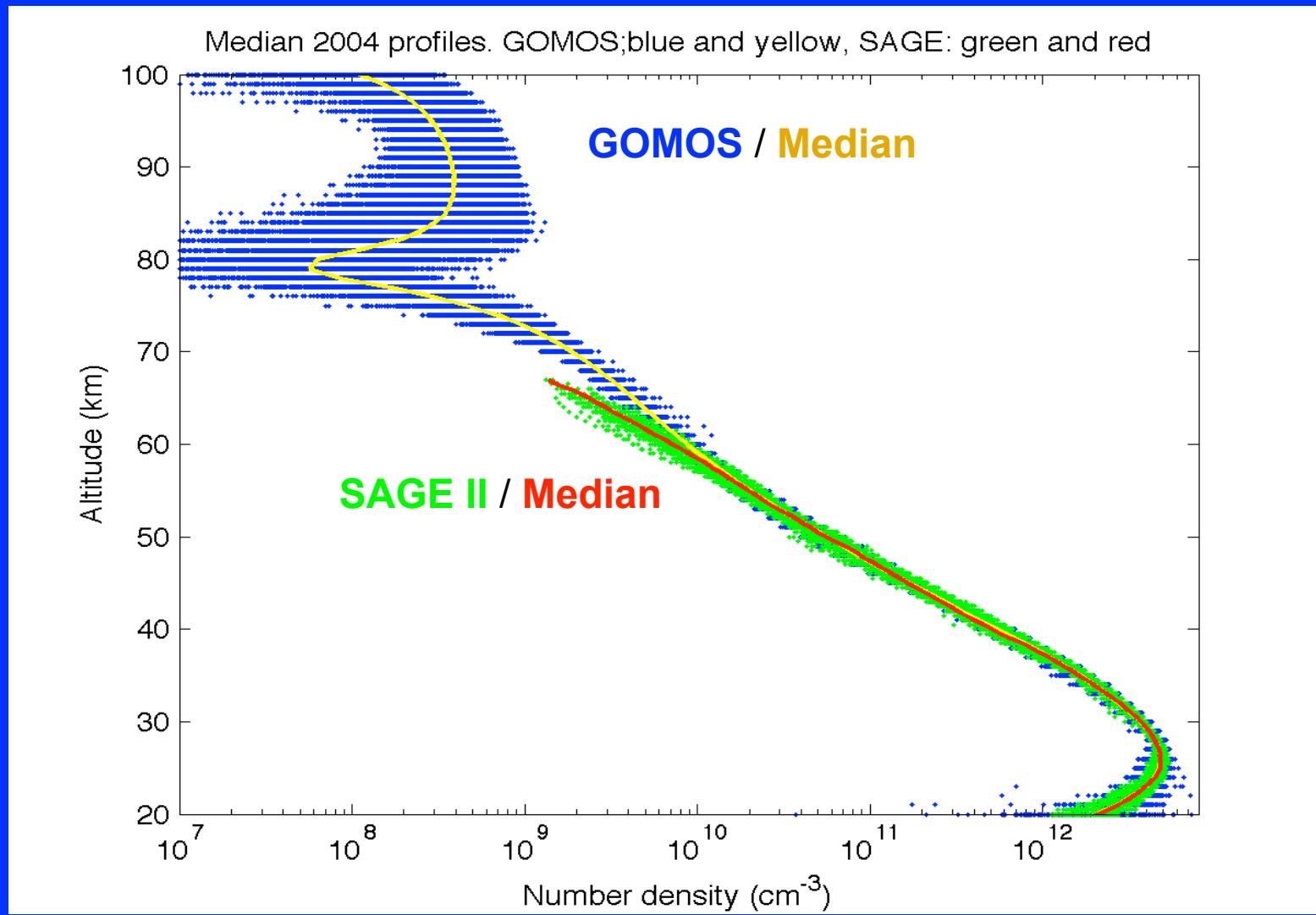
- O<sub>3</sub> vertical profiles: 6-70 km with 1 km resolution
- Sunrise/Sunset
- Operational 1984-2005



# GOMOS

- O<sub>3</sub> vertical profiles: 15-100 km with 2-3 km resolution
- Nighttime data
- Operational 2002-2014

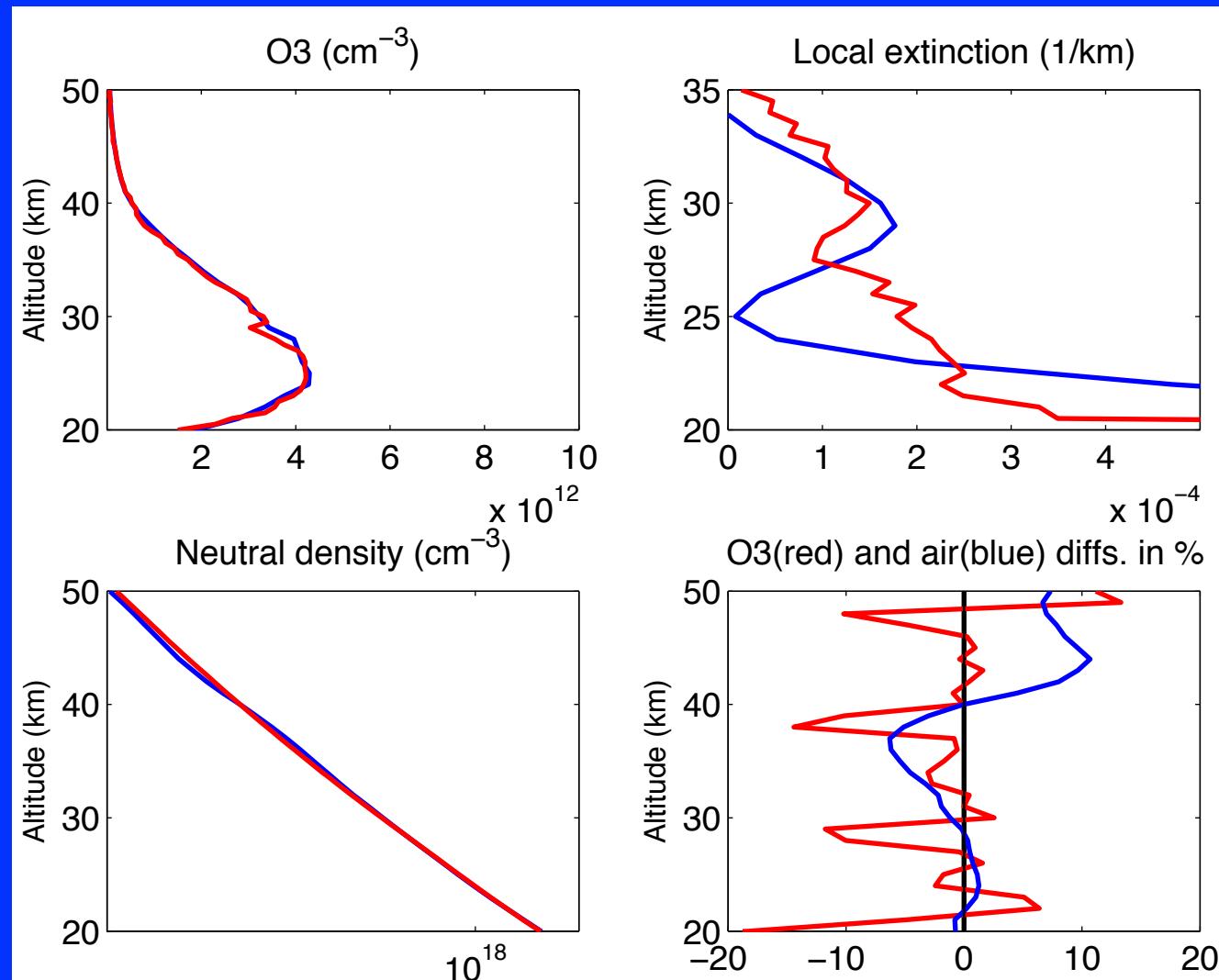
## GOMOS profiles vs SAGE II profiles at equator



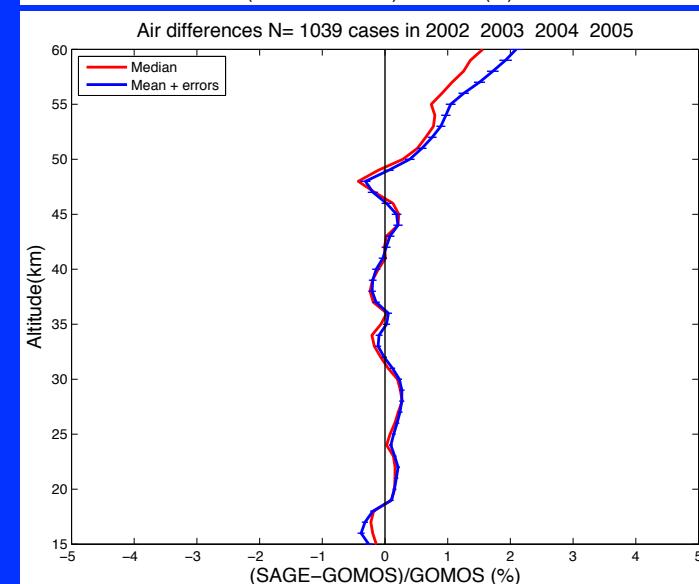
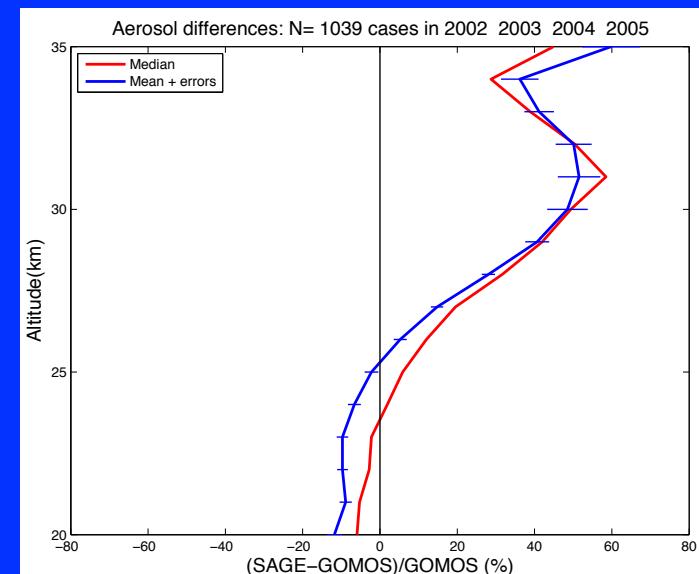
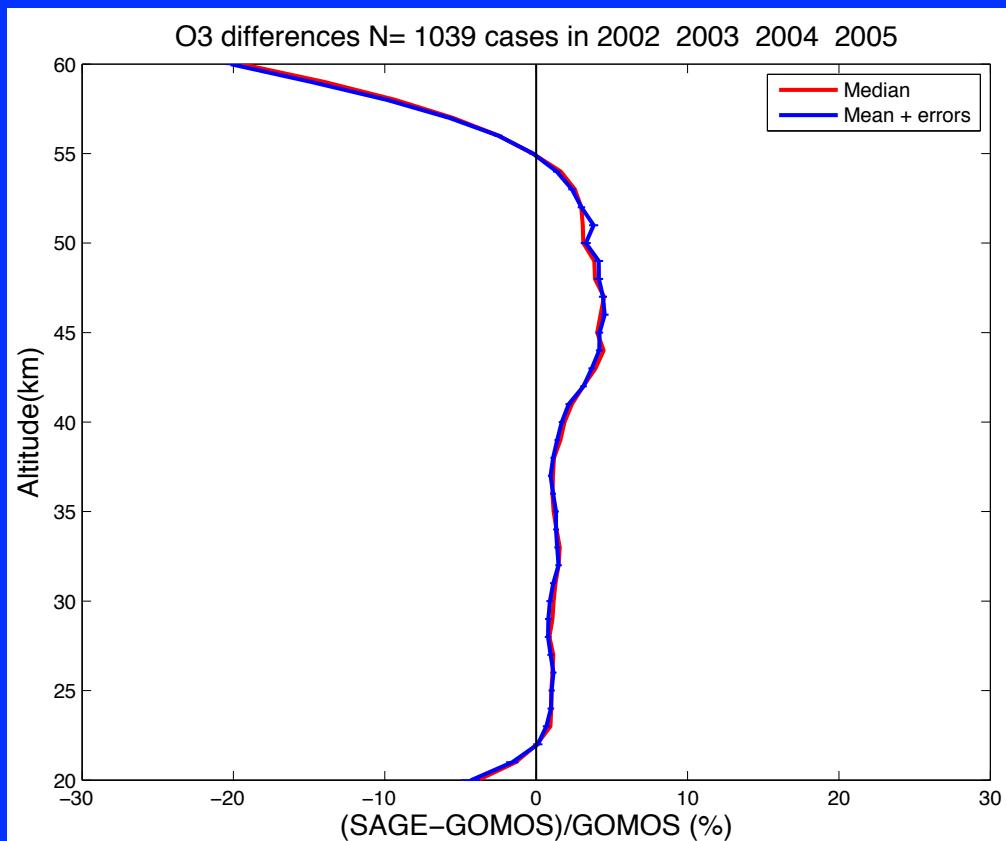
## GOMOS and SAGE II ozone retrievals compared

	GOMOS	SAGE II
<b>Wavelengths</b>	250-675 nm	600 nm (one pixel)
<b>Interfering species</b>	Rayleigh from ECMWF O <sub>3</sub> , NO <sub>2</sub> , NO <sub>3</sub> and aerosols retrieved simultaneously	Rayleigh from NMC Aerosols from 1000 nm extrapolated to 600 nm NO <sub>2</sub> from 448 nm removed
<b>Cross sections</b>	Bogumil et al.	Anderson et al.
<b>Local time</b>	10 pm	Sunrise/Sunset

## Example of colocated SAGE II and GOMOS profiles in 2002

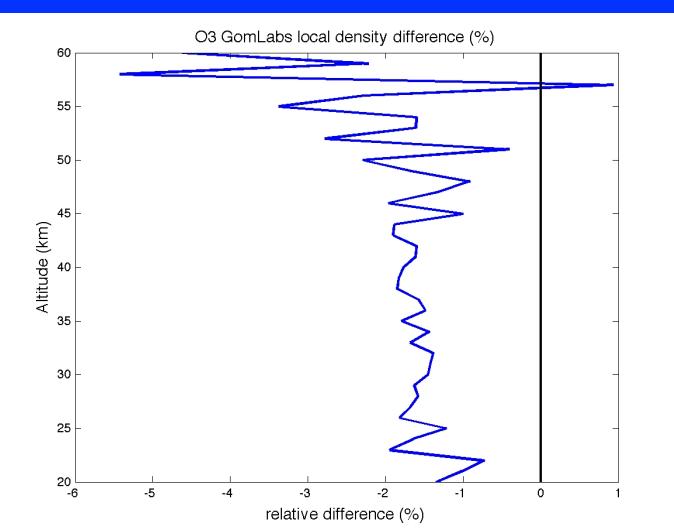
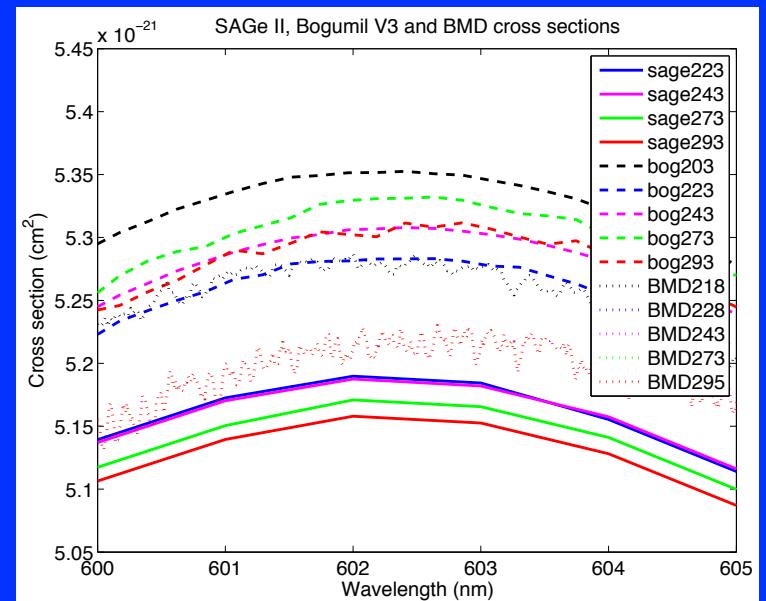
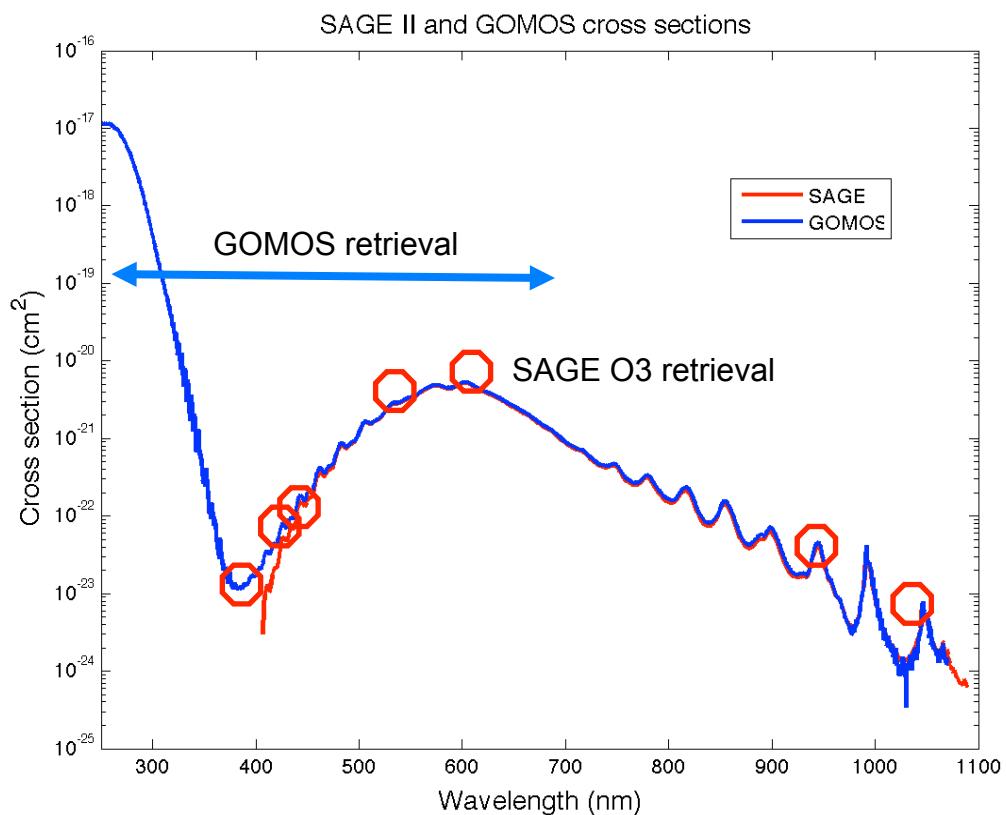


# Averages from all colocated measurements 2002-2005



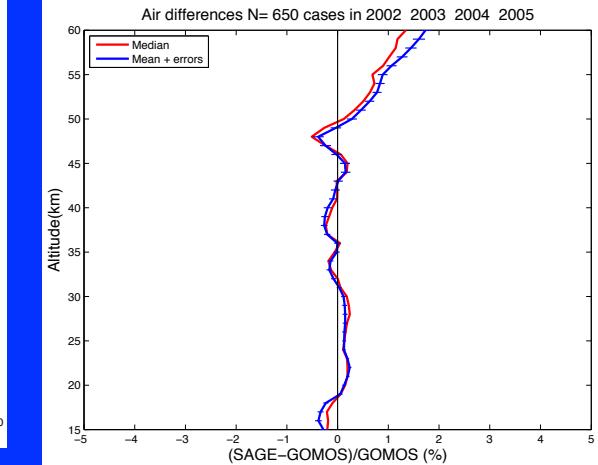
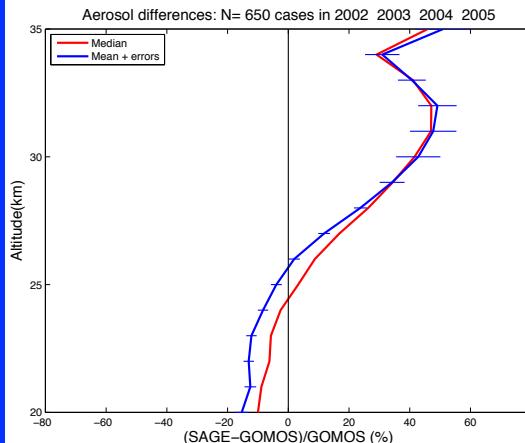
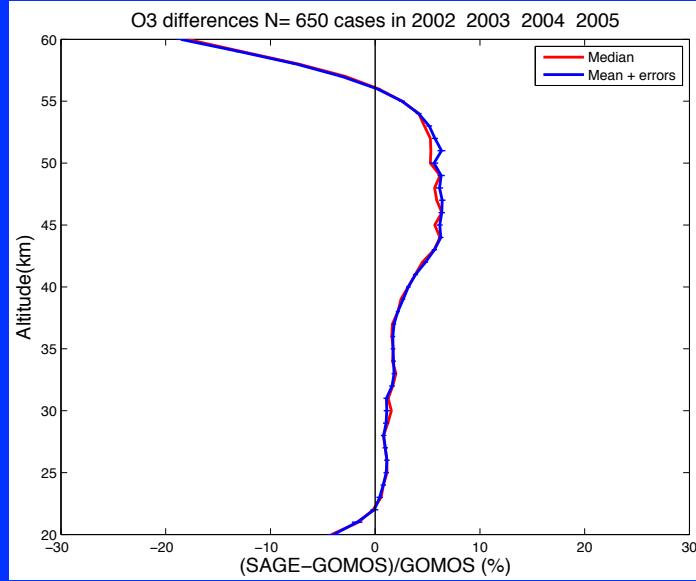
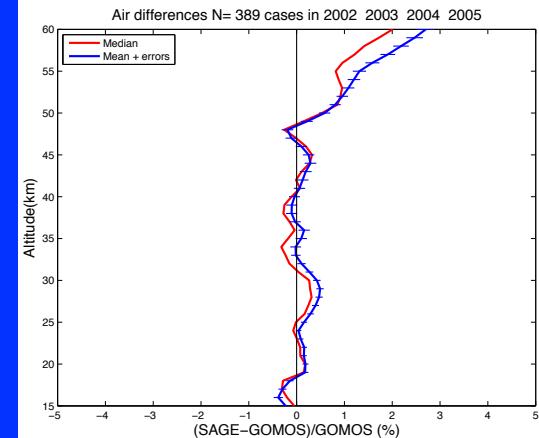
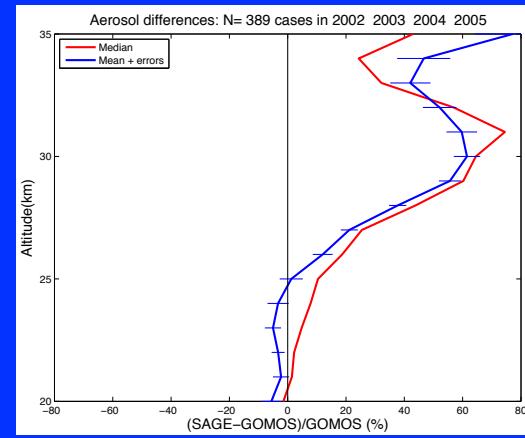
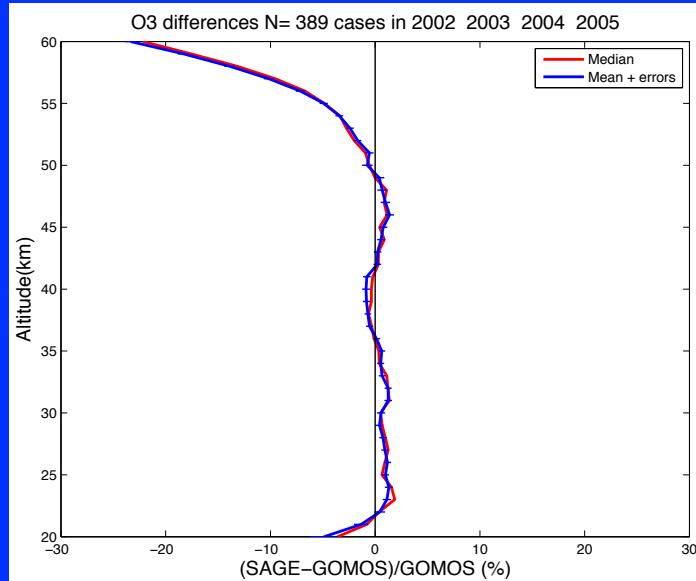
lat. diff<2 deg  
lon. diff. <10 deg  
time diff. < 12 h

# GOMOS and SAGE II ozone cross sections



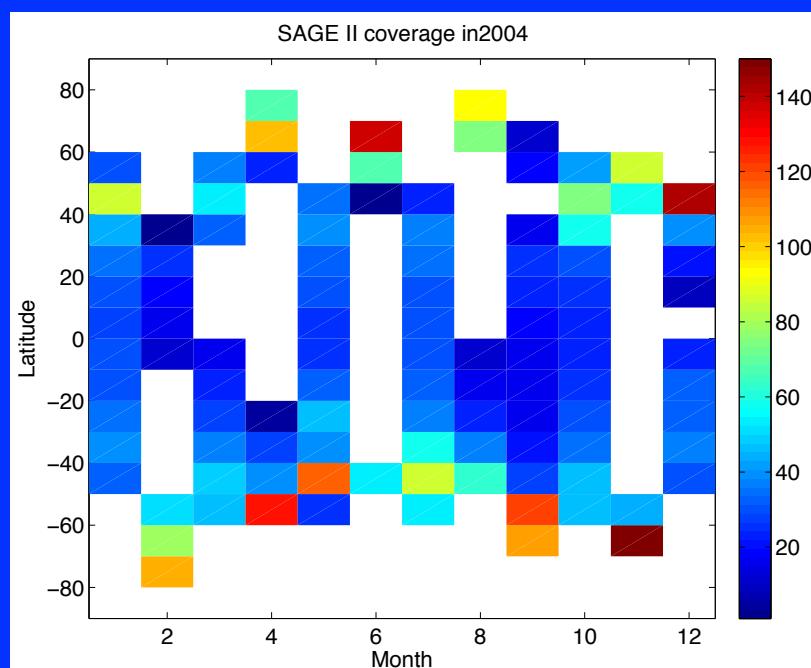
Impact of ozone cross  
section change on  
GOMOS O<sub>3</sub>

# Averages from sunrise/sunset measurements

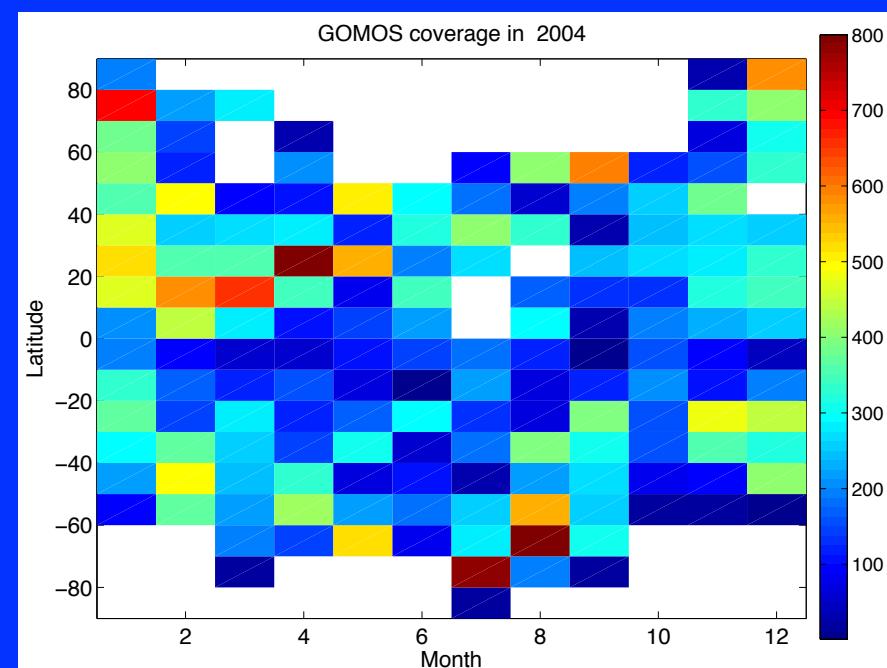


# Time-latitude coverage

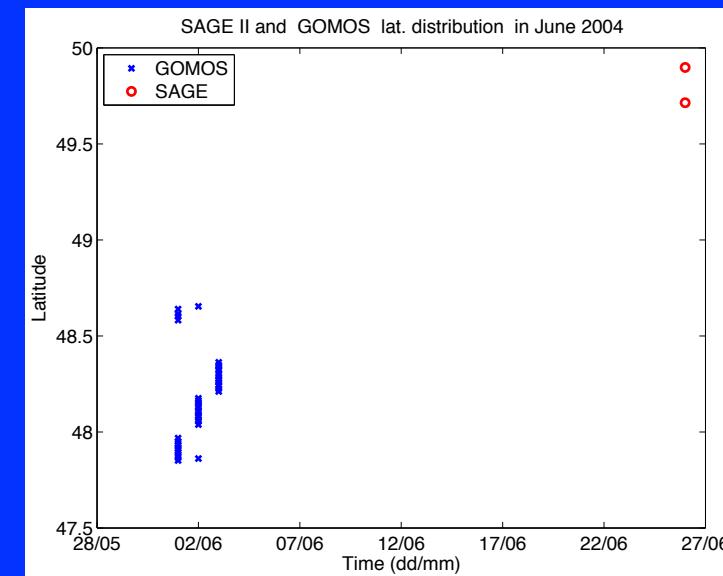
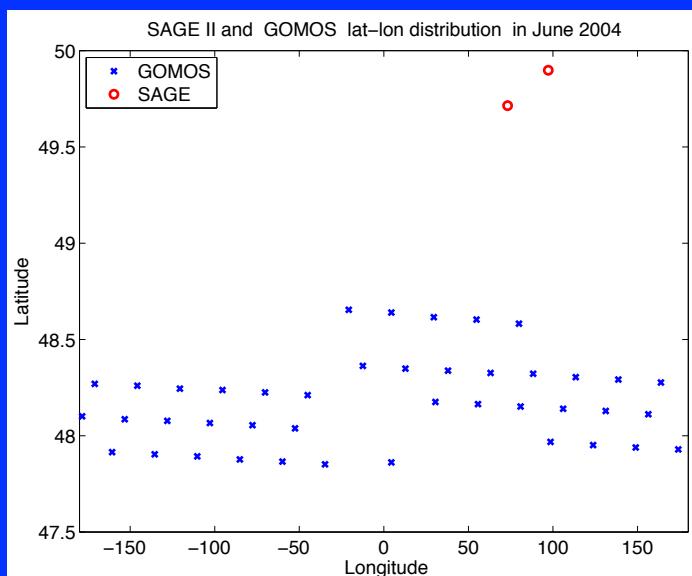
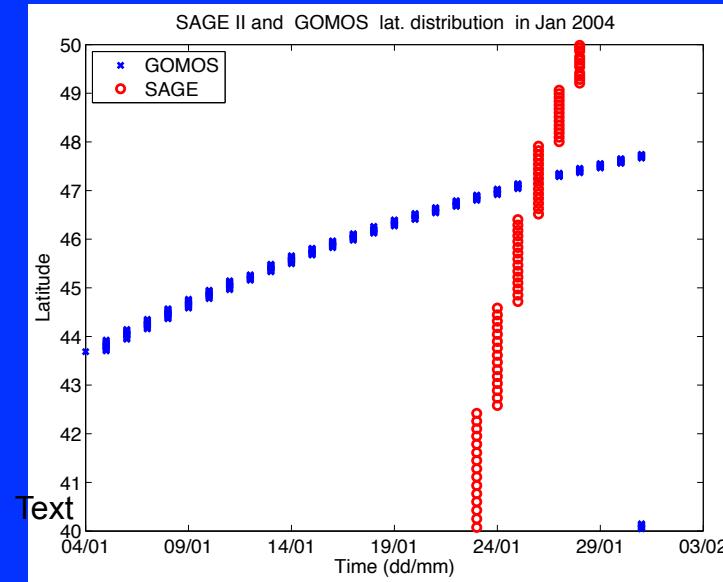
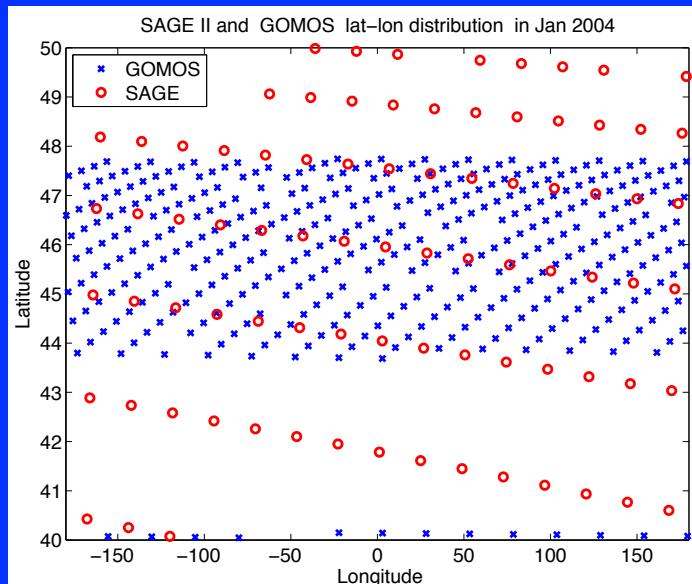
170 000 occultations



350 000 night occultations



# Examples of lat-lon-time coverage

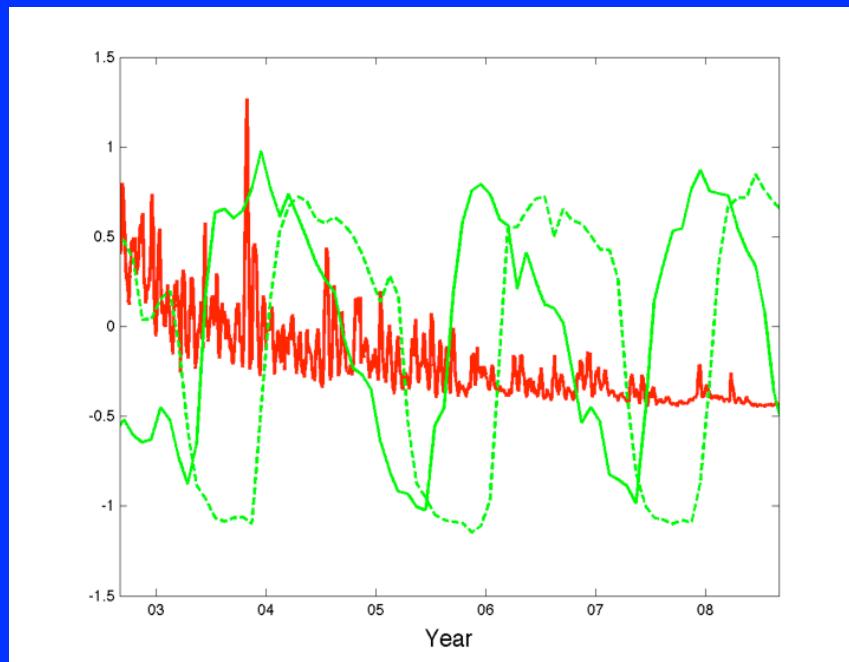


## How to make a combined data set?

- Presently the differences between GOMOS and SAGE II and sunset/sunrise differences in SAGE II data are not fully understood.
- Using SAGE II-GOMOS bias profiles for sunset and sunrise we correct all the SAGE II ozone profiles to agree with GOMOS data in the colocated measurements.
- This creates one homogeneous data set for 1984-2011.

# Example of time series fitting of SAGE II-GOMOS

$$\begin{aligned}\rho^{\text{fit}}(z, t) = & c(z) + r(z)t + s(z)F_{10.7}(t) + q_1(z)F_{qbo}^{10}(t) + q_2(z)F_{qbo}^{30}(t) \\ & + \sum_{n=1}^2 (a_n(z) \cos(nwt) + b_n(z) \sin(nwt))\end{aligned}$$



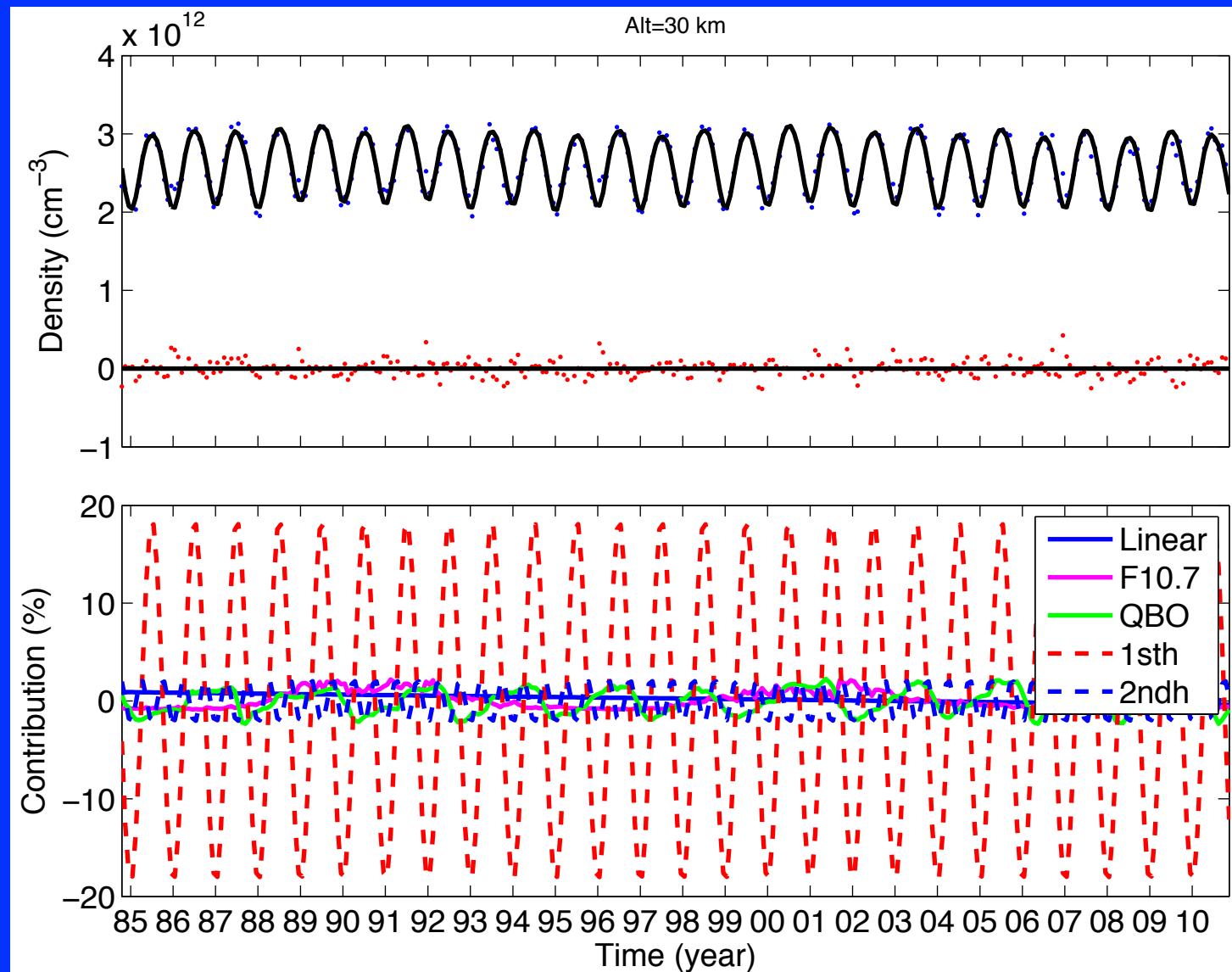
**Latitude 40N-50N**

**1 km vertical grid, monthly  
medians, errors, quality control**

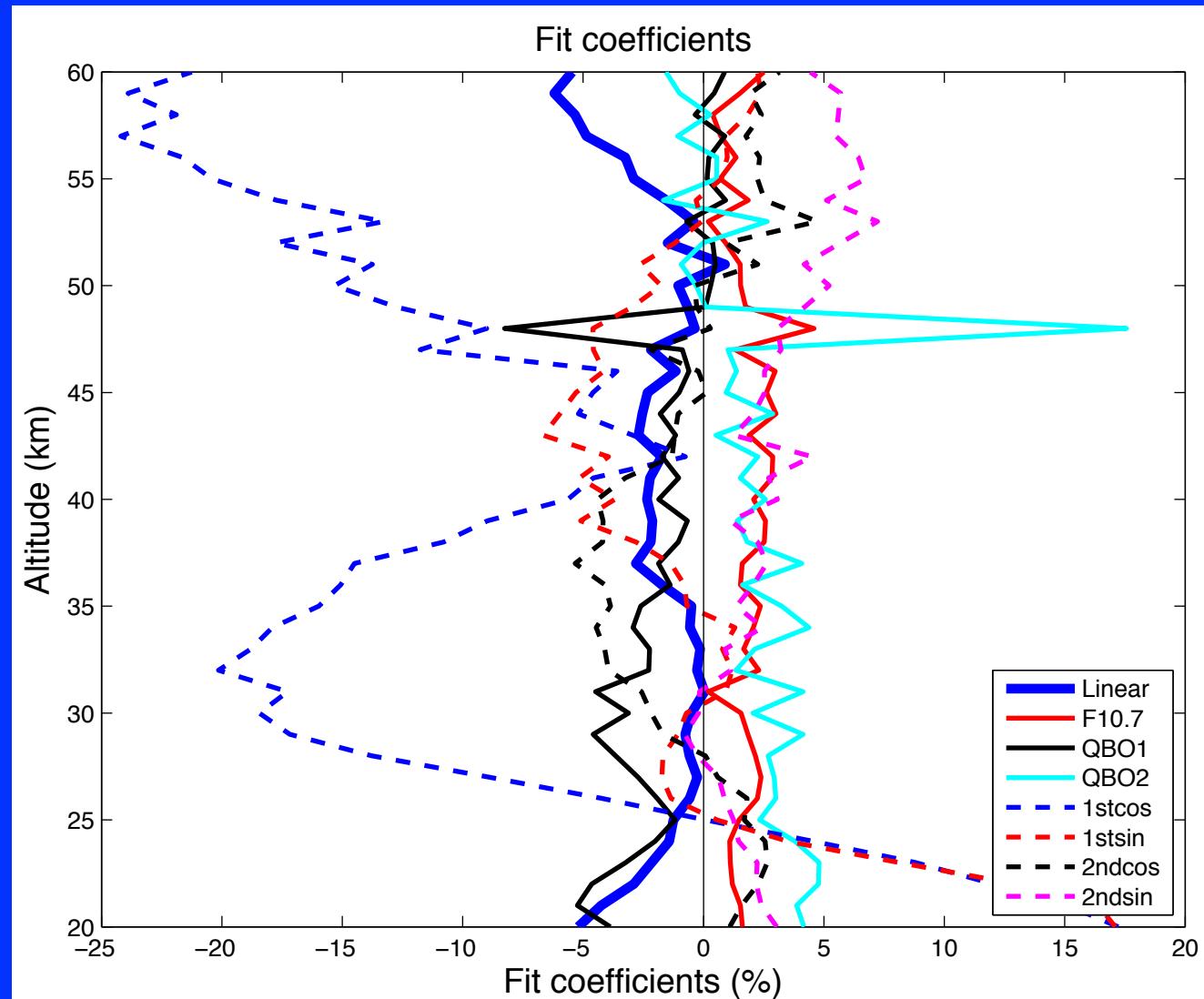
**Number densities at geometrical  
altitudes.**

**Fitting by linear weighted LSQ**

## Example of fitting



# Fitting coefficients



# Conclusions

- ★ GOMOS-SAGE II differences are small.  
They are not fully understood.
- ★ SAGE II-GOMOS bias corrected ozone  
time data look viable data set for trend  
analysis 1984 - 2011.

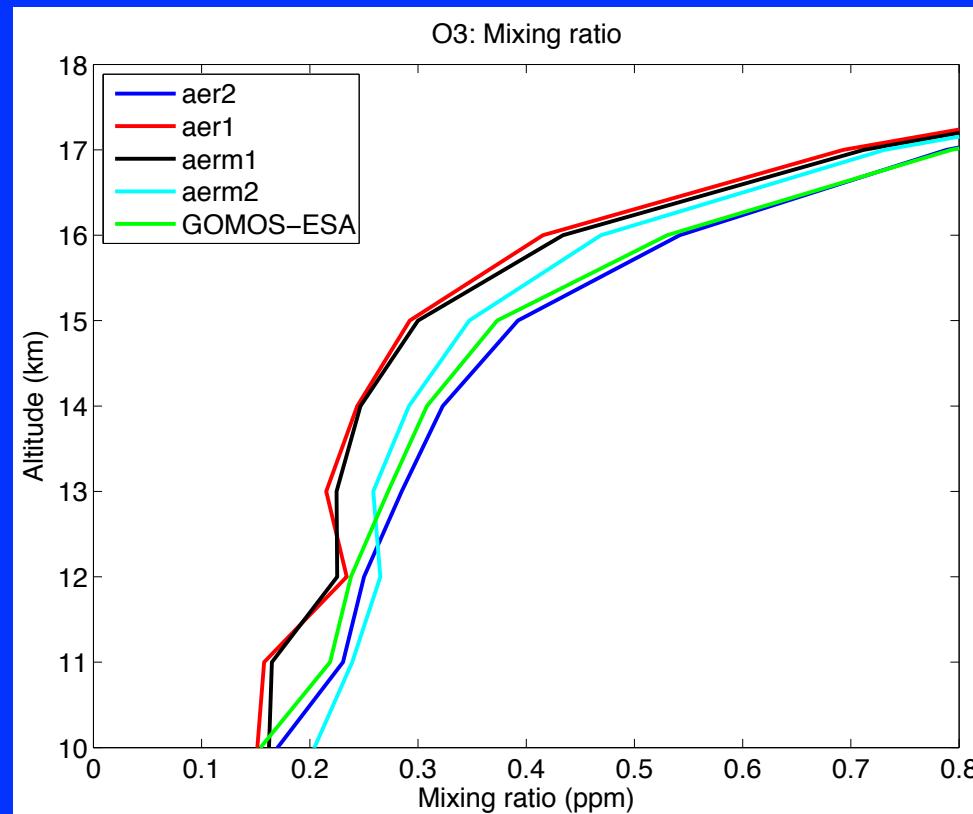
# Aerosol effects

$aer2 = a + b \lambda + c \lambda^2$  GOMOS version 5

$aer1 = a + b \lambda$

$aerm1 = a + b / \lambda$

$aerm2 = a + b / \lambda + c / \lambda^2$



GomLab retrievals from GOMOS-data using different aerosol models